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Iron medication.

Experimental and Clinical Investigation

OF

IRON MEDICATION

BASED ON LABORATORY TESTS AND BEDSIDE OBSERVATIONS CONTINUED FOR OVER TWO YEARS WITH ESPECIAL REFERENCE

TO

IRON TROPON

BY

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REPRINT FROM
WIENER MEDIZINISCHE
WOCHENSCHRIFT.
No. 12-14, 1905.

NEW YORK:
MARTIN B. BROWN COMPANY, PRINTERS AND STATIONERS,
NOS. 49 TO 57 PARK PLACE.

1906.

Experimental and Clinical Investigations

OF

IRON TROPON.

By Dr. ERICH MATZNER, Birkfeld.

The following report contains the results obtained in investigations extending over two years. The space at my disposal does not allow of an extensive description of every detail employed by me in my researches, so I have embodied herein only the salient and most important material in as concise a form as possible.

The experiments and methods of research employed by me are divided into the following parts:

I. Tests of absorption. (A) On chickens and mice; demonstration by chemical and microscopical means of the iron which has been absorbed in upper tract of the intestine; also of deposition of same in the liver and spleen (B) on human beings; macroscopical and microscopical demonstration of iron in the organs obtained at autopsy.

II. Researches about the regeneration of the blood based on: (A) The demonstration of lively excitation in the bone marrow and increase of haematopoietic elements. (B) Observation of the Eosinophiles in the circulating blood and comparative study of the Eosinophile curve.

III. Elimination. (A) Demonstration of the iron which has been eliminated through the large and small intestines. (B) Determination of iron eliminated as an organic compound in the urine of healthy and of anaemic individuals according to the method of Damaskin.

IV. Clinical observations of Chlorosis, Anaemia, Marasmus and Debility, convalescence after serious acute infections, Tuberculosis and Neurasthenia, based on: (A) Proof of constant increase of the red blood cells. (B) Determination of percentage of haemoglobin in the blood according to the method of Fleischl and by means of the ferrometer scale. (C) Comparative determination of weight and blood pressure (the latter only in Neurasthenia).

V. Chemical investigation.

I.—ABSORPTION.

For the purpose of demonstrating by microchemical means the absorption of iron, I employed the following method which was first perfected by Quincke. The object being hardened in alcohol and imbedded in celloidin, after being treated with Ferrocyancali-hydrochloric acid, is stained with saturated pikrinic acid solution instead of alum carmine. Treated in this way even the smallest particles of iron showed up beautifully in contrast with the yellow color of the tissue in which they were imbedded. To avoid repetitions I shall make no separate report on the results obtained on chickens, mice and on human beings, as no important differences were observed, except those slight deviations caused by the difference of the tissue construction in the different objects, or where in different animals different organs perform the same physiological functions. For instance, the results of the investigations on the iron elimination in the colon of mice and human beings, in chickens apply to the caecum, for in most birds this organ performs the physiological function which in mammalia is performed by the colon.

Chickens and mice received 3 grammes of Iron Tropon per day, human beings, 12 grammes, administered per os. The test animals were killed in from 8 to 12 days. One of the patients had duraltumor, the other had chronic inflammation of the kidneys, and both were kept alive on an exclusive milk diet. Both died, one 11 and the other 17 days after the beginning of iron medication. No iron was encountered either in the gizzard of the chickens or in the fundus of the stomach of the other subjects.

In the pylorus occasionally traces of Iron were found; the upper zone of the surface epithelium was lightly tinted green; some particles of iron could be detected in the tissue surrounding the nucleus of the cells, and particles of iron were also enclosed in some of the leukocytes imbedded in the mucin producing cells of the surface epithelium. The Duodenum is undoubtedly the principal organ of iron absorption. Villus after villus shows the same picture. Through the staining process the epithelium of the villi has taken on a green tint, which in the apices is of lighter color, while the basic layers of cells show color scales from light malachite to dark emerald green, a convincing demonstration that the deeper cells contain the larger amount of iron. Everywhere the iron particles are of the minutest size—they might justly be called molecular—only in the basic layers of cells we find more compact quantities of iron in the form of very fine rods and specks. A similar condition

confronts us in the lacteals of the villi, where we find the amount of iron increasing from the apex towards the base; in part they are small particles of free iron and in part larger flakes enclosed in leukocytes. Very little iron is found in the stroma of the villi. It is now not difficult to trace the further course and the final deposition of the iron. Past the lymph follicles of the intestinal wall, which are stained dark bluish green, through the primary beginning of the lymphatic system where everywhere both free and combined iron are encountered, we are led to the lymphatic system of the mesentery. After staining with sulphur ammonium Ferrocyancali-hydrochloric acid, it is even possible without artificial help to detect the iron in the form of very minute, black or dark green rods or specks. Seen through a magnifying glass these rods and specks prove to be a conglomeration of the most minute particles.

Most of the iron, which has been absorbed, does not pass from the intestines into the lymphatic channels of the mesentery in the form of free iron, but enclosed in large mononuclear leukocytes. In the mesenterial lymph glands, however, through which the lymph stream passes, an important change takes place. They act, so to say, as a filter, for in it the leukocytes are broken up, the iron is liberated and on leaving the periphery of the gland all iron is in the form of free particles.

Gaule succeeded in demonstrating absorbed iron after 40 minutes in the lymph of the ductus thoracicus. I, however, came to the conclusion, that this happens with excessive quantities only, and that normally the iron is transported through the vasa efferentia from the upper mesenterial lymph glands to the liver and there deposited. If the test animal is given very small quantities of Iron Tropon, the lymph of the duct practically shows no traces of iron.

The lymph channels carry iron to the spleen in the same way as to the liver and a strong reaction to iron was always obtained.

The liver and spleen are to be regarded as the principal organs of iron deposit. Up to this point we can follow the iron step by step, but from here on it escapes our observation until we find it again when it is eliminated from the body by way of the large intestine as unnecessary ballast in the form of metallic iron or as an organic compound. Some of it also can be demonstrated in the stroma of the kidneys, but by far the largest quantity is eliminated as a firm organic constituent in the urine. But even though we have lost trace of the iron and cannot follow it after it has been deposited in the spleen and liver we can

recognize something, and that is its pharmaco-dynamic effects on the animal and human organism.

II.—REGENERATION OF THE BLOOD.

Chlorosis is, without doubt, a hypoplasia, a deterioration of the haematopoietic organs, principally of the bone marrow, which on account of its diminished power cannot furnish a sufficient number of normal Erythrocytes. To cover as much as possible the demand of the body for red blood cells, it throws into the blood current Poikylocytes below normal size and poor in haemoglobin and even Normoblasts, *i. e.*, unripe erythrocytes.

The harm done through this diminished power of the bone marrow is in many cases aggravated by a hypoplasia of the blood carrying parts, the glandular system and even the genital sphere. The former definition of Chlorosis as being caused by a defective absorption of the iron in the food, through which defect the amount of haemoglobin in the blood was thought to be reduced, cannot be any longer upheld. The same may be said of the contention that the molecule of iron underwent a close combination with the molecule of the haemoglobin, *i. e.*, that the red coloring matter of the blood was being evolved out of the iron.

Haemoglobin is built up from the food iron, the absorption of which in uncomplicated cases of Chlorosis does not seem to be diminished. Diminished or, we might say, sleeping, is only the vital energy, the activity and productiveness of the bone marrow. To rekindle its activity a spur or excitation is necessary; and it is not the increased quantity of iron in the organism which only needs minute quantities for the formation of haemoglobin, but the excitation exerted on the bone marrow by the absorbed iron which causes it to produce healthy, and in size and form as well as in percentage of haemoglobin, normally constituted blood cells.

Into the bone marrow the iron, enclosed in transport cells, is carried by the blood current, which fact has been demonstrated especially by Hoffman, by means of tying off tests. The demonstration of this fact is best carried out in the following manner: Cut out a column of the bone marrow 5 to 8 mm. in length, immerse for 24 hours in a mixture of absolute alcohol and 5 per cent. sulphuric Ammonium for hardening, imbed in paraffin, cut in slices and fix with glycerine Albumen. After this immerse the objects in xylol for quite some time to remove the paraffin, afterwards for one hour in $(NH_4)_2S$, wash in distilled water and put them in glycerine under the cover glass.

In this manner I have investigated the bone marrow of numerous animals. Where ordinarily these transport cells hardly ever show any traces of iron and never larger particles of it, in animals which had been fed on Iron Tropon for several days, especially if before that they had been fed on iron poor material, the result was strikingly different, as the transport cells carried large and distinctly visible masses of iron. In conformity with the observations of Hoffman, Hoger, Strowinsky, Rudinger and Rindfleisch, I also found these transport cells sometimes more numerous in the central part of the marrow, sometimes again in the peripherial part, now singly, now in groups of from 2 to 4, but each carrying from 2 to 5 iron flakes deposited around the nucleus of the cells.

These iron carrying transport cells were found in the largest quantity in those parts of the bone marrow where the capillaries become venous. Here their lumen is increased to 3 or 4 times its ordinary size and the blood comes into immediate contact with the cells of the parenchym of the marrow. Here, where the circulation of the blood is very much retarded and where a direct contact between the marrow and the circulating blood takes place, the iron carrying cells appear in increased quantity and also penetrate into the parenchym of the marrow. It is these iron carrying cell-like elements which exert that peculiar revivifying influence on the bone marrow through which a large proliferation of normoblasts is engendered, these normoblasts being changed into normal erythrocytes while still within the marrow. This excitation engendered through the iron cells is the healing agent in Chlorosis.

It is therefore evident that any other physiolgical influence which can encompass a heightened activity of the medulla is equally efficient as a factor in the recovery from Chlorosis. We know that outside of iron there is not a more efficient spur to activity in cell generation of the bone marrow than loss of blood. Well known is the quick restoration of blood after secondary anaemias, the reason for which has been found to be the increased activity of the marrow (Laacke, Oppenheimer, Liebe).

Now the first question which presents itself is this: Are we able to demonstrate in an exact manner the above described increase in the activity of the bone marrow? Yes. The easiest way would be if we could induce Chlorosis in test animals. This, however, we have so far not been able to accomplish. Von Hoselin succeeded, by feeding test animals on food deficient in iron, and by repeatedly bleeding them, to reduce very much below par the percentage of Haemoglobin in their blood and

their power of resistance to fatigue; they also showed marked anaemia of the mucous membranes and increased pulse rate. But this is not the real spontaneous Chlorosis but rather a state of oligocythaemia and oligochromaemia consequent upon secondary anaemia. For my own five tests I chose ten animals of equal weight and equal age and in which the blood test showed about the same number of red corpuscles and the same percentage of haemoglobin. 1/13 of the weight was accepted as representing the whole weight of the blood, and from all animals a relatively equal amount of blood proportionate to the weight was drawn off. They were kept in separate stalls and fed on green vegetables, milk and bread. Five animals received from the start 5 grams of Iron Tropon per day. After 12 days the percentage of Haemoglobin and the number of red blood corpuscles were ascertained. Coverglass preparations with Ehrlich's Eosinhaematoxylin stain were made, the animals killed and the bone marrow investigated after the method of Hoffman. The animals marked B were the ones fed with Iron Tropon. By means of a pair of fine scissors pieces of the marrow about the size of a pin head were taken and put between two coverglasses, where they are evenly distributed over the glass. Dry in the air, fix in alcohol-ether mixture and stain with Eosin Haematoxylin or triacid solution.

	At Start Before Venesection.		First Day After Venesection.		Twelve Days After Venesection.	
	Red Blood Corpuscles.	Haemoglobin per cent.	Red Blood Corpuscles.	Haemoglobin per cent.	Red Blood Corpuscles.	Haemoglobin per cent.
I a	5,200.000	70	3,260.000	42	3.540.000	55
I b	5.180.000	70	3,250.000	40	4,120,000	65
II a	4,940.000	75	3,060 000	35	3,400.000	50
II b	4,920.000	75	3,050.000	35	3,950.000	60
III a	5,060,000	70	4,020.000	38	4,460.000	63
III b	5,080.000	72	4,150.000	41	4,800.000	75
IV a	4,600.000	68	3,120.000	36	3.500.000	52
IV b	4,620,000	70	3,160,000	36	4,120.000	68
V a	5,300.000	85	3,500,000	45	4,020.000	60
V b	5,290.000	83	3,480.000	43	5,100.000	75

It will be seen at a glance that those animals which were fed on Iron Tropon replaced the lost blood much quicker than those fed on ordinary food. After 12 days of iron medication those animals fed on Fe made a far more favorable showing than the others, the red blood corpuscles of the former being from 340,000 to 1,080,000 in excess and the percentage of haemoglobin 10 to 17 per cent. But we can also observe directly in the marrow the increased production of red corpuscles or their predecessors, the nucleated normoblast.

For the investigation I made 8 cover slides each of the bone marrow of the ten test animals and found the following facts: In the bone marrow of the animals fed with Iron Tropon, as well as in that of the others, fed on food poor in iron, extremely lively regenerating processes were going on, caused in the latter class through the excitation set up by the loss of blood alone, in the former through the influence exerted by the loss of blood combined with that of iron ingestion. In accordance with this the cell proliferation in the animals fed on Iron Tropon was so much more lively and the number of newly formed normoblasts so much more numerous that this difference could not be simply a coincidence, but could only be the result of the added excitation exerted by the iron. The capillaries in the parenchym of the marrow were stuffed with red corpuscles, but also the parenchym itself was thickly filled with large masses of nucleated red cells in different stages of evolution and innumerable mature red corpuscles. In the angles formed by the branching of the capillaries, grape-like bunches of newly formed blood cells could be seen; in fact, the microscopic picture of the marrow presented an entirely foreign and bewildering appearance. But it is not alone the red blood cells and normoblasts which are increased to such a surprising degree, but also the colorless cells of the marrow show the same phenomenon in equal proportion. Of these colorless marrow cells Arnold distinguishes four types:

1. Small leukocytes with dark, round nucleus which almost fills the cell.
2. Large cells with narrow plasma rim and round indented nucleus.
3. Cells with wide plasma rim and round indented nucleus in form of a horseshoe or basket.
4. Cells with wide or narrow plasma rim and polymorphous nucleus.

Cell types 1 and 2 were oftenest met with during the formative process; so often, that their appearance in such numbers in the lymphoid marrow of animals intentionally rendered

anaemic, could only be interpreted as showing them to have a close and direct connection with the formation of new blood. The definite proof of this awaits only a reliable agent of microchemical reaction for very minute quantities of haemoglobin, which at present is lacking. It seems, however, proven beyond doubt through these investigations, where the animals fed on Iron Tropon showed a so much more lively cell proliferation than those fed on ordinary food, that the administration of iron causes a more rapid and numerous regeneration of blood cells in the bone marrow. Although Hoffman could not observe a striking difference regarding the amount of white blood corpuscles be nevertheless detected in some of his cover-slide preparations an increased amount of eosinophile cells. Engel observed that after bleeding and iron medication the total number of eosinophiles increased from 1% of the total leukocytes to 5%, 9½%, 14%. I myself paid especial attention to this matter with the following result: Normally the number of eosinophile cells is about 1% of the total number of white blood cells; after copious bleeding this number is at once reduced to 0.60-0.75%. But very soon the number begins to increase above the normal, on the second day to 2%, in 5 to 6 days to 4½ to 5%, until in about two weeks a maximum amount of 6½ to 7½% is reached. Having remained at this figure for several days, a slow but steady decrease sets in, so that after 3 weeks we find 4%, after 4 weeks 2% of eosinophiles, until in about 6 weeks the normal of 1% is again reached, at which time the loss of blood has been made up, and the percentage of haemoglobin and the number of red blood corpuscles is also again normal.

If the test animal or the patient suffering from secondary anaemia receives a preparation containing iron—I gave Iron Tropon—a higher percentage of eosinophiles is reached much quicker. Engel observed 14% , I myself mostly not more than 12 to 12½%, in one case, however, 17%.

My opinion is that the number of eosinophile cells in the blood is a direct indication of the degree of energy of blood cell regeneration in the bone marrow. The higher the comparative percentage of eosinophiles to white blood cells the more lively is the proliferation of normoblasts in the marrow. The observation of this eosinophile curve furnishes us an important help to diagnosing on our patients the more or less lively activity of the bone marrow. The observations so far have clearly proven that:

1. Iron Tropon is perfectly absorbed by the small intestine, is carried by the lymphatic system to the liver and spleen and that it is there deposited.

2. That iron is carried into the bone marrow by the blood current, and that there the iron sets up peculiar and beneficent excitation, which causes a remarkable increase in the formation of red blood corpuscles.

III.—ELIMINATION.

Through which organs is the iron eliminated from the body? Through the intestines, gallbladder and the kidneys. It is a well known fact that quantitative determinations of iron in the feces are of no value, as so far we have no means or methods by which it is made possible to separate or distinguish the iron, which has been absorbed and eliminated, from that, which has simply passed through the alimentary canal without playing any role in the organism. The qualitative proof of iron in its elimination through the large intestine however, is rather easy. To fix as nearly as possible the time when elimination begins, I prepared the alimentary canal of rabbits and mice for the test by cleaning it with water-enemata and mild laxatives. I then gave, through a funnel per·os. 2 grammes of Iron Tropon in milk, and successively killed one of the animals every two hours. In this manner I found that the elimination begins in from 6 to 8 hours, reaches its highest point in from 14 to 16 hours, and after 20 hours the elimination recedes. In one animal which had received only one dose of 2 grams of Iron Tropon and afterward was fed on iron poor food, small but unmistakable traces of iron elimination could be observed after 5 days. The iron is first encountered in the Duodenum in the stratum underneath the glandular mucosa. It is partly free and partly enclosed in leukocytes. The nearer the surface epithelium of the intestine is approached the less frequently do we find the iron in the free state, so we may reasonably conclude that the iron which is to be eliminated is carried to the surface by transport cells.

By microchemical means it can be shown that through the kidney iron is eliminated only in the most minute particles. Nevertheless a considerable quantity of iron is eliminated through the urine but this is not to be proven by microchemical means. The quantity can only be determined by the method of Damaskin. The value of this method of determination of closely combined organic iron is, that through it only such iron is accounted for which has in fact been for some time within the circulating fluids of the organism and which has been intimately combined with them and formed part of the living economy of the body.

Iron, however, be it inorganic or organic, which simply passes through the body without intimately combining with it, soon reappears in the urine and may be demonstrated by the usual methods.

For the investigation of the urine-iron elimination after D: 6 people were selected, three healthy individuals, two chlorotics and one suffering from secondary anaemia. Each person excrētes daily about 1 mg. of urine-iron (the amounts vary from 0.0008 to 0.0012); for the investigation it is necessary that the persons undergoing it should submit to a strictly even diet for some days before, during and after the taking of the iron preparation, which diet, according to Fischler and A. Beddies is sufficiently nutritive if it contains 100 gr. of albumen, 280 gr. carbohydrates and 90 gr. fat, or the equivalent of 2400 calories.

Name, Age.	Red Blood Cells, Percentage of Haemoglobin.	Date.	Amount of Urine-Iron Grammes.
Robert S., 32 years	4,450,000 90	February 4	0.001
		February 5	0.001
		February 6	0.0014
		February 7	0.0015
		February 8	0.0018
		February 9	0.0020
			Iron stopped
		February 10	0.0020
		February 12	0.0015
		February 14	0.0012
Engelbert H., 29 years	4,500,000 95	March 16	0.001
		March 18	0.0013
		March 19	0.0018
		March 21	0.0021
		March 23	0.0021
			Iron stopped
		March 25	0.0018
		March 27	0.0016
		March 29	0.0011
Anna F., 28 years	4,160,000 90	March 23	0.0009
		March 25	0.0012
		March 27	0.0017
		March 29	0.0020
		March 31	0.0020
			Iron stopped
		April 2	0.0016
		April 4	0.0012

Name, Age.	Date.	Diagnosis.	Amount of Urine-Iron, Grammes.	Red Blood Cells.	Percentage of Haemoglobin.
Berta H., 23 years.	May 3	Chlorosis.	0.0009	3,120.000	30
	May 5		0.001	—	—
	May 9		0.0012	3,140.000	30
	May 22		0.0013	3,260.000	35
	June 4		0.0015	3,350.000	40
	June 17		0.0015	3,520,000	50
	June 29		0.0015	3,580.000	65
	July 11		0.0016	3,740.000	75
	July 28		0.0022	3,950.000	85
Marie P., 21 years	Aug. 11	Chlorosis.	0.0010	3,430.000	40
	Aug. 13		0.0010	—	40
	Aug. 16		0.0013	—	40
	Sept. 5		0.0012	3,590,000	50
	Sept. 19		0.0014	3,620,000	55
	Oct. 11		0.0015	3,840.000	65
	Oct. 23		0.0020	3.950.000	80
Rosa N., 35 years	Nov. 3	Anaemia post partum	0.0008	2,820.000	35
	Nov. 10		0.0012	3,050.000	45
	Dec. 2		0.0012	3,230,000	60
	Dec. 15		0.0014	3,640.000	70
	Jan. 3		0.0019	3,890.000	85

The above tabulation teaches this:

If a healthy person takes iron, the quantity of excreted urine iron increases on the 2nd and 3rd day to 0.0014-0.0016, to 0.0020-24 on the 5th or 6th day (an increase of 200 to 240%). Once the maximum is reached the quantity is not exceeded and after stopping the intake of iron, it slowly recedes so that the normal of 0.0010 is not again reached before the 5th or 6th day. Entirely different results are observed when the subject is chlorotic or anaemic; on the 2nd or 3rd day the quantity of excreted urine iron also amounts to 0.0010 or 0.0012, but then the rapid increase ceases; in periods of from 2 to 3 weeks the quantity only increases some tenth of a milligramme; amounts of 0.0020-0.0022 and 0.0024, as in healthy people, are reached only after months, *i. e.*, when the anaemia or chlorosis have been cured by the iron preparation. It is therefore evident that in individuals with impoverished blood a part of the ingested iron is retained in the circulation. Only those preparations which show this slow elimination in form of urine iron answer the purpose for which an iron preparation is administered. Iron Tropon certainly has these qualities to an exceptional degree as the above figures unquestionably prove.

CLINICAL INVESTIGATIONS.

The results of these experimental investigations left little doubt about the therapeutic success of Iron Tropon in actual practice. I deem it best to tabulate the results obtained by me with Iron Tropon in 13 cases of Anaemia and 21 cases of Chlorosis without giving a tedious history of each individual case, which were all more or less identical, and showed the same symptoms. I wish, however, to state that on account of its very agreeable taste, Iron Tropon was praised by all patients without exception, and that it never caused any intestinal trouble. With the improvement of the blood the symptoms of weakness, shortness of breath and accelerated heartbeats slowly disappeared. With a daily dose of 25 grammes of Iron Tropon a restoration of perfect health could invariably be brought about in from 10 to 12 weeks.

ANA

	Name and Age.	Diagnosis.	Red
			At Start.
1	R. K., 32 yrs.	Anaemia—Abortion	2,820.000
2	B. K., 27 yrs.	Anaemia Metroorhagia	3,050.000
3	A. Kl., 19 yrs.	"	2,600.000
4	K. H., 31 yrs.	"	3,010.000
5	Th. T., 29 yrs.	"	2,730.000
6	A. T., 45 yrs.	Haemoptoe	3,150.000
7	B. J., 42 yrs.	"	2,670 000
8	Th. L., 36 yrs.	"	3,560,000
9	K. K., 25 yrs.	"	3.290.000
10	N. J., 19 yrs.	Haematemesis	3,170.000
11	B. H., 35 yrs.	Lead Poisoning	3,500.000
12	Ki L., 62 yrs.	Arterial Bleeding	2,260.600
13	F. J., 50 yrs.	Neurasthenia	3,510.000

EXHAUSTED AND DEBILITATED CONDITIONS.

In considering Marasmus or marantic or debilitated forms, the physiological state of marasmus senile is strictly to be distinguished from the pathological marasmus, a consequence of serious illness such as carcinoma, diabetes, etc. While 32-38 calories in the food value per day and kilogram of weight are necessary for a man of middle age at complete rest in bed for the maintenance of the equilibrium of his body functions, 25 calories per day and kilogram are often more than sufficient for old people, who may even gain weight on it. In their case the nutritive substances are perfectly utilized, and the relative proportion of the nitrogenous substances in the urine remains within

normal bounds. The senile involution, it appears to me, must be based upon a primary lesion of the cells, on which on the one hand is based their ability to subsist on an abnormally small amount of food, while on the other hand it (the lesion) prevents an increase above a relatively low maximum in the activity of the cell, in spite of the ingestion of a large amount of food. The inorganic substances of the food seem to be governed by different rules for they are either absorbed by the intestine in smaller quantity or eliminated by them in increased amounts. If this is correct, then even the ingestion of large quantities of nutritive preparations by old people would be of no use as the cells are unable to dispose of more than a limited quantity of food material. When, however, in old people there is an unusual loss of weight or when on account of catarrh of the stomach the latter is not able to assimilate a quantity of ordinary food products

EMIA

Blood Corpuscles.		Haemoglobin per cent.			Weight in Kilograms.		
After 6 Weeks.	After 12 Weeks.	At Start.	After 6 Wks.	After 12 Wks.	At Start.	After 6 Weeks.	After 12 Weeks.
3,650.000	4.140.000	35	55	75	62.4	63.8	65.2
3,940.000	4,220.000	40	55	70	52.3	53.4	54.8
3,440.000	3,870.000	30	50	65	47.5	48.2	49.4
3,600.000	4,000.000	40	55	65	51.6	51.9	53.2
3,140.000	3,820.000	30	45	70	49.9	—	52.6
3,640.000	4,140.000	40	60	75	48.6	49.2	50.6
2,980.000	3,540.000	30	40	60	49.9	49.3	50.4
3,870.000	4,050.000	40	55	70	52.5	—	53.9
3,650.000	3,880.000	45	60	65	50.7	50 9	51.5
3,680.000	3,950.000	60	65	70	52.1	52.6	53.4
3,720.000	3,890.000	40	50	65	49.6	50.5	51.3
3,420.000	4,160.000	28	45	70	60.5	60.8	70.1
3,840.000	3.980.000	50	60	65	—	60.2	61.4

sufficient for the needs of the body, then these nutritive preparations serve a very good purpose. To test these deductions I chose five persons of from 78 to 83 years of age, some of whom were steadily losing more weight without apparent cause than could reasonably be expected, while others on account of catarrh of the stomach were forced to observe a very restricted diet in regard to quantity as well as quality. I must say that the results obtained with Iron Tropon were quite satisfactory; I am convinced that the irresistible process of gradual dissolution has been visibly retarded by the administration of this product. Under Iron Tropon medication it took 2½ times as long for the loss of a certain amount of weight than it did without it.

CHLOROSIS

All cases of girls from 14–26 years of age. Case 11 is suspected tuberculosis. Case 21 is pronounced phthysis of apices. Case 13 complicated by ulcer of the stomach.

No.	Red Blood Corpuscles.			Haemoglobin Per Cent.			Eosinophyle Per Cent.			Remarks.
	At Start.	After 6 Weeks.	After 12 Weeks.	At Start.	After 6 Weeks.	After 12 Weeks.	At Start.	After 6 Weeks.	After 12 Weeks.	
1	3,820.000	3,870.000	3,950.000	35	48	65				The first symptoms of beginning improvement generally were felt in more regular heart beats and facility of breathing; in the 4th week increase of bodily vigor was experienced. Of the 21 patients under observation, 9 were suffering from amenorrhoe. Seven of these menstruated regularly after two months of treatment.
2	3,640.000	3,920.000	4,060.000	32	44	59				
3	3,520.000	3,740.000	4,020.000	42	64	78				
4	3,640.000	3,920.000	4,140.000	36	55	70				
5	3,780.000	3,950.000	4,070.000	49	67	75	1	6	5	
6	4,040.000	4,050.000	4,110.000	42	59	68				
7	3,140.000	3.460 000	3,870.000	40	55	65	0.8	4.2	4.5	
8	3,600.000	3,820.000	4,070.000	35	50	65				
9	3,460.000	3,700.000	3,940.000	40	58	72	1	3	5	
10	3,550.000	3,800.000	3,950.000	50	48	70	1	4	7	
11	3,190.000	3,500.000	3,730.000	35	45	58				
12	3,260.000	3,470.000	3,850.000	35	50	68				
13	3,730.000	3,800.000	3,960.000	50	58	70				
14	3,540.000	3,630.000	3,870.000	38	52	74				
15	3,500.000	3,590.000	4,040.000	43	59	70				
16	3,700.000	3,860.000	3,990.000	45	58	65	1	7	6	
17	4,020.000	4,150.000	4,230.000	50	65	70				
18	3,620.000	3,920.000	4,000.000	32	45	75	1	4	3	
19	3,540.000	3,750.000	3,960.000	40	55	70				
20	3,800.000	3 950.000	4,080.000	52	62	70				
21	3,020.000	3,340.000	3,620.000	30	45	55				

CONVALESCENCE AFTER ACUTE INFECTIOUS DISEASES AND FEVER.

During serious acute infections the body is not in a condition of metabolic equilibrium. The increased combustion and the heightened energy of all vital functions of the body during fever soon disturb the balance and increases the N. excretion from 28.4 to 51.87% over the normal. The urinary excretion of a fever patient exceeds by far the intake of nitrogen and oxygen, the consequence of which is that the body consumes itself, principally its own albumen substance. A convalescent, therefore, after passing through an acute infectious disease, shows an albumen deficit. If the convalescent is now given albumen it is seen that to give only the quantity which was consumed during the progress of the disease is not sufficient to stop further loss of it, but that about 2½ times as much albumen has to be taken if a further excessive loss is to be avoided. If very much albumen was lost during the course of the disease, large quantities of albuminous foods are necessary to replace it, quantities which the weakened economy is hardly able to extract from the ordinary food products. And here it is where the modern nutrient preparations, especially Iron Tropon, demonstrate their value to an exceptional degree. While the large amount of pure albumen contained in the Iron Tropon enables us to replace considerable loss of albumen with small quantities of this preparation, its iron components exert a favorable influence on the composition of the deteriorated blood by the induction of a formative excitation of the bone marrow. I gave Iron Tropon with gratifying results in 6 cases during convalescence after typhus abdominalis, 4 after Pneumonia, 2 diphtheria and 5 scarlet fever. In the shortest time the bodily vigor returned and the lost weight was regained.

On account of lack of space I have to reserve for a later article the descriptions of my experience with Iron Tropon in Neurasthenia and the investigations into its chemical constitution.

NAME	DATE DUE